What is claimed is:

1. A method for radio communication between a first device having N plurality of antennas and a second device having M plurality of antennas, comprising a step of processing a vector **s** representing L signals [s_1 ... s_L] with a transmit matrix **A** that is computed to maximize capacity of the channel between the first device and the second device subject to a power constraint that the power emitted by each of the N plurality of antennas is less than or equal to a maximum power, whereby the transmit matrix **A** distributes the L signals [s_1 ... s_L] among the N plurality of antennas for simultaneous transmission to the second device.

2. The method of claim 1, wherein the step of processing comprises processing the vector **s** with the transmit matrix **A** that is computed subject to the power constraint being different for one or more of the N plurality of antennas.

3. The method of claim 1, wherein the step of processing comprises processing the vector **s** with the transmit matrix **A** that is computed subject to the power constraint being the same for each of the N plurality of antennas.

4. The method of claim 3, wherein the step of processing comprises processing the vector **s** with the transmit matrix **A** that is computed subject to the power constraint for each of the N plurality of antennas being equal to a total maximum power emitted by all of the N plurality of antennas combined divided by N.

5. The method of claim 4, wherein the step of processing comprises multiplying the vector **s** with the transmit matrix **A**, where the transmit matrix **A** is equal to **VD**, where **V** is the eigenvector matrix for $\mathbf{H}^H\mathbf{H}$, **H** is the channel response from the first device to the second device, $\mathbf{D} = \mathrm{diag}(d_1,\ldots,d_L)$ and $|d_p|^2$ is the power of the p^{th} one of the L signals.

6. The method of claim 5, wherein when $N \leq M$, the step of processing comprises multiplying the vector **s** with the transmit matrix **A**, where $\mathbf{D} = \mathbf{I} \cdot \mathrm{sqrt}(P_{max}/N)$, and **I** is the identity matrix, such that the power transmitted by each of the N plurality of antennas is the same and equal to P_{max}/N.

7. The method of claim 5, wherein when $N < M$, the step of processing comprises multiplying the vector **s** with the transmit matrix **A**, where $\mathbf{D} = \text{sqrt}(d \cdot P_{max}/N_{Tx}) \cdot \mathbf{I}$, such that the power transmitted by antenna i for i = 1 to N is $(d \cdot P_{max}/N) \cdot (\mathbf{VV}^H)_{ii}$, and $d_p = d$ for p = 1 to L.

8. The method of claim 7, wherein the step of processing comprises multiplying the vector **s** with the transmit matrix **A**, where $d = 1/z$ and $z = \max_i \{(\mathbf{VV}^H)_{ii}\}$, such that the maximum power from any of the N plurality of antennas is P_{max}/N and the total power emitted from the N plurality of antennas combined is between P_{max}/M and P_{max}.

9. The method of claim 7, wherein the step of processing comprises multiplying the vector **s** with the transmit matrix **A**, where d = 1, such that the power emitted by antenna i for i = 1 to N is $(P_{max}/N) \cdot (\mathbf{VV}^H)_{ii}$, and the total power emitted from the N plurality of antennas combined is P_{max}/M.

10. The method of claim 1, and further comprising the steps at the second device of receiving at the M plurality of antennas signals transmitted by the first device, and processing signals received at each of the plurality of M antennas with receive weights and combining the resulting signals to recover the L signals.

11. The method of claim 1, wherein each of the L signals is baseband modulated using a multi-carrier modulation process, and wherein the step of processing comprises multiplying the vector **s** with a transmit matrix **A**(k) at each of a plurality of sub-carriers k.

12. A radio communication device, comprising:
    a. N plurality of antennas;
    b. N plurality of radio transmitters each coupled to a corresponding one of the plurality of antennas;
    c. a baseband signal processor coupled to the N plurality of radio transmitters to process a vector **s** representing L signals $[s_1 \ldots s_L]$ with a transmit matrix **A** that is computed to maximize capacity of the channel between the first device and the second device subject to a power constraint that the power emitted by each of the N plurality of antennas is

less than or equal to a maximum power, whereby the transmit matrix **A** distributes the L signals $[s_1 \ldots s_L]$ for simultaneous transmission to the second device by the N plurality of antennas.

13. The device of claim 12, wherein the baseband signal processor processes the vector **s** with a transmit matrix **A** that is computed subject to the power constraint being different for one or more of the N plurality of antennas.

14. The device of claim 12, wherein the baseband signal processor processes the vector **s** with a transmit matrix **A** that is computed subject to the power constraint being the same for each of the N plurality of antennas.

15. The device of claim 14, wherein the baseband signal processor processes the vector **s** with a transmit matrix **A** that is computed subject to the power constraint for each of the N plurality of antennas being equal to a total maximum power emitted by all of the N plurality of antennas combined divided by N.

16. The device of claim 15, wherein the baseband signal processor multiplies the vector **s** with the transmit matrix **A,** where the transmit matrix **A** is equal to **VD**, where **V** is the eigenvector matrix for $\mathbf{H}^H\mathbf{H}$, **H** is the channel response from the device to another device having M plurality of antennas, $\mathbf{D} = \mathrm{diag}(d_1,\ldots,d_L)$ and $|d_p^2|$ is the power of the p^{th} one of the L signals.

17. The device of claim 16, wherein when $N \leq M$, the baseband signal processor multiplies the vector **s** with the transmit matrix **A** that is computed where $\mathbf{D} = \mathbf{I} \cdot \mathrm{sqrt}(P_{max}/N)$, and **I** is the identity matrix, such that the power transmitted by each of the N plurality of antennas is the same and equal to P_{max}/N.

18. The device of claim 16, wherein when $N < M$, the baseband signal processor multiplies the vector **s** with the transmit matrix **A** that is computed where $\mathbf{D} = \mathrm{sqrt}(d \cdot P_{max}/N_{Tx}) \cdot \mathbf{I}$ such that the power emitted by antenna i for i = 1 to N is $(d \cdot P_{max}/N) \cdot (\mathbf{VV}^H)_{ii}$, and $d_p = d$ for p = 1 to L.

19. The device of claim 18, wherein the baseband signal processor multiplies the vector **s** with the transmit matrix **A** that is computed where $d = 1/z$ and $z = \max_i\{(\mathbf{VV}^H)_{ii}\}$ such that the maximum power from any antenna of the N

plurality of antennas is P_{max}/N and the total power emitted from the N plurality of antennas combined is between P_{max}/M and P_{max}.

20. The device of claim 18, wherein the baseband signal processor multiplies the vector **s** with the transmit matrix **A** that is computed where d = 1, such that the power emitted by antenna i for i = 1 to N is $(P_{max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$, and the total power emitted from the N plurality of antennas combined is P_{max}/M.

21. The device of claim 12, wherein each of the L signals is baseband modulated using a multi-carrier modulation process, and the baseband signal processor multiplies the vector **s** with a transmit matrix **A**(k) at each of a plurality of sub-carriers k.

22. A radio communication system comprising:

   a. a first device comprising:

      i. N plurality of antennas;

      ii. N plurality of radio transmitters each coupled to a corresponding one of the plurality of antennas; and

      iii. a baseband signal processor coupled to the N plurality of radio transmitters to process a vector **s** representing L signals $[s_1 \ldots s_L]$ with a transmit matrix **A** that is computed to maximize capacity of the channel between the first device and the second device subject to a power constraint that the power emitted by each of the N plurality of antennas is less than or equal to a maximum power, whereby the transmit matrix **A** distributes the L signals $[s_1 \ldots s_L]$ for simultaneous transmission to the second device by the N plurality of antennas;

   b. a second device comprising:

      i. M plurality of antennas;

      ii. M plurality of radio receivers each coupled to a corresponding one of the plurality of antennas; and

      iii. a baseband signal processor coupled to the N plurality of radio receivers to process signals output by the plurality of radio

receivers with receive weights and combining the resulting signals to recover the L signals $[s_1 \ldots s_L]$.

23. The system of claim 22, wherein the baseband signal processor of the first device processes the vector **s** with the transmit matrix **A** that is computed subject to the power constraint being different for one or more of the N antennas.

24. The system of claim 23, wherein the baseband signal processor of the first device processes the vector **s** with the transmit matrix **A** that is computed subject to the power constraint being the same for each of the N plurality of antennas.

25. The system of claim 24, wherein the baseband signal processor of the first device processes the vector **s** with the transmit matrix **A** that is computed subject to the power constraint for each of the N antennas being equal to a total maximum power emitted by all of the N antennas combined divided by N.

26. The system of claim 25, wherein the baseband signal processor of the first device multiplies the vector **s** with the transmit matrix **A,** wherein the transmit matrix **A** is equal to **VD**, where **V** is the eigenvector matrix for $\mathbf{H}^H\mathbf{H}$, **H** is the channel response from the device to another device having M plurality of antennas, $\mathbf{D} = \mathrm{diag}(d_1,\ldots,d_L)$ and $|d_p|^2$ is the power of the p^{th} one of the L signals.